DESCRIPTION

EVAPORATOR

CROSS REFERENCE TO RELATED APPLICATION

This application is an application filed under 35 U.S.C. §111(a) claiming the benefit pursuant to 35 U.S.C. §119(e)(1) of the filing date of Provisional Application No. 60/529,572 filed December 16, 2003 pursuant to 35 U.S.C. §111(b).

TECHNICAL FIELD

The present invention relates to evaporators for use in motor vehicle air conditioners which are refrigeration cycles to be installed in motor vehicles.

The term "aluminum" as used herein and in the appended claims includes aluminum alloys in addition to pure aluminum. The downstream side (the direction indicated by the arrow X in FIGS. 1 and 10, the upper side of FIG. 2, and the right-hand side of FIG. 11) of the air to be passed through the air flow clearance between each adjacent pair of heat exchange tubes will be referred to herein and in the appended claims as "front," and the opposite side as "rear." Further the upper and lower sides of FIGS. 1 and 10 will be referred to as "upper" and "lower," respectively. The terms "front," "rear," "upper" and "lower" are thus defined for the sake of convenience, "front" and "rear," as well as "upper" and "lower," may be used as replaced by each other.

BACKGROUND ART

Evaporators of the stacked plate type have found wide use in motor vehicle air conditioners. Such an evaporator comprises a heat exchange core having a plurality of flat refrigerant passing bodies arranged in parallel with their widths oriented in a front-rear direction and corrugated fins arranged between respective adjacent pairs of refrigerant passing bodies, and a refrigerant inlet header and a refrigerant outlet header positioned on the upper side of the heat exchange core and arranged side by side in the front-rear direction. The evaporator has a plurality of flat hollow bodies each comprising two vertically elongated rectangular plates brazed to each other along peripheral edges thereof and having bulging refrigerant passageway portions and bulging header forming portions continuous with opposite ends of the passageway portions, the flat hollow bodies being arranged side by side with opposed outer faces of corresponding header forming portions in contact with each other, the corresponding header forming portions of each adjacent pair of flat hollow bodies being joined to each other at their outer faces, the refrigerant passing bodies of the heat exchange core being provided by the passageway portions of the flat hollow bodies, the inlet header and the outlet header being provided by the corresponding header forming portions of the flat hollow bodies, the inlet header and the outlet header having a refrigerant inlet and a refrigerant outlet respectively, louvered corrugated fins being arranged respective adjacent pairs of refrigerant passing bodies and each brazed to the refrigerant passing bodies adjacent thereto.

With such evaporators of the stacked plate type, the inlet of the inlet header and the outlet of the outlet header are provided respectively at the widthwise opposite ends of the heat exchange core or at one end of the core. In either case, the evaporator is used as housed in a case in the vehicle compartment.

As an evaporator of the stacked plate type wherein the refrigerant inlet of the inlet header and the refrigerant outlet of the outlet header are provided respectively at widthwise opposite ends of the heat exchange core, already known is an evaporator having a corrugated fin brazed to the outer side surface of an end refrigerant passing body positioned at each of opposite ends of a heat exchange core, a side plate brazed to the outer side of the corrugated fin, a refrigerant inflow member extending in the front-rear direction and connected to the inlet above the side plate at one core end, and a refrigerant outflow member extending in the front-rear direction and connected to the outlet above the side plate at the other core end. The inflow member and the outflow member are each in the form of a tube having a square or rectangular cross section, open at one end and closed at the other end and are each provided with a pipe joint opening at the open end. The inflow member and the outflow member are connected, each at one side wall thereof, to the inlet and the outlet, respectively, and have an inlet pipe and an outlet pipe connected to their respective pipe joint openings. Each of the inflow and outflow members has an outer side face positioned within an upward extension of the plane of outer side surface of the side plate or inwardly

of the extension (see the publication of JP-A No. 7-190560).

On the other hand, known as an evaporator of the stacked plate type wherein the refrigerant inlet of the inlet header and the refrigerant outlet of the outlet header are provided at the same one end of the heat exchange core with respect to the widthwise direction thereof is an evaporator which has an end plate joined to the outer side of a refrigerant passing body at one end of a heat exchange core where a refrigerant inlet and a refrigerant outlet are provided, the end plate having joined thereto a block joint provided with two communication openings communicating respectively with the inlet and the outlet, an inlet pipe and an outlet pipe being attached by a piping block joint to the block joint so as to communicate with the respective communication openings (see the publication of JP-A No. 8-14702).

Reduced weight is required of stacked plate-type evaporators from the viewpoint of improvements in the fuel cost of motor vehicles and environmental reasons, while such evaporators must be compacted and need to be housed in a case of reduced size from the viewpoint of assuring the vehicle compartment of an enlarged space to give comfort although the vehicles are limited in size.

The evaporators of the stacked plate type wherein the refrigerant inlet of the inlet header and the refrigerant outlet of the outlet header are provided respectively at widthwise opposite ends of the heat exchange core include those having an overall width which is equal to the width of the heat exchange core as disclosed in the publication of JP-A No. 7-190560.

In this case, the evaporator can be accommodated in a case without creating any useless space inside the case, and if the evaporator is compacted, the case can be made smaller in size.

However, with evaporators of the stacked plate type wherein the refrigerant inlet of the inlet header and the refrigerant outlet of the outlet header are provided at the same one end of the heat exchange core with respect to the widthwise direction thereof, the block joint and the piping block joint are provided as outwardly projected from the heat exchange core as disclosed in the publication of JP-A No. 8-14702. Furthermore, the inlet pipe and the outlet pipe attached to the piping block joint are made to extend laterally outwardly of the core once and then bent forward or rearward. Accordingly, when the evaporator is housed in a case, useless space exists inside the case, with the result that even if the evaporator is compacted, the case can not be made small-sized. Moreover, air will pass through the useless space, permitting uncooled air to flow into the vehicle compartment to entail a lower refrigeration efficiency. To preclude the impairment of cooling efficiency, the space needs to be blocked up with a heat insulating material, whereas this leads to an increased material cost and requires a cumbersome procedure. The block joint and piping block joint necessary for connecting the inlet pipe and the outlet pipe to the inlet and the outlet increase the number of components while making the inlet pipe and the outlet pipe complex in shape. If the inlet pipe and the outlet pipe become complex in shape, the bent portions will have a diminished radius of

curvature to give a reduced cross sectional area to the flow channel, consequently entailing an increased refrigerant pressure loss to result in impaired heat exchange performance.

An object of the present invention is to overcome the above problems and to provide an evaporator wherein the refrigerant inlet of the inlet header and the refrigerant outlet of the outlet header are formed at the same one end of the heat exchange core with respect to the widthwise direction thereof and which can be housed in a case without creating any useless space inside the case so that the case can be made smaller in size.

DISCLOSURE OF THE INVENTION

1) An evaporator comprising a heat exchange core having a plurality of flat refrigerant passing bodies arranged in parallel at a spacing with their widths oriented in a front-rear direction and first corrugated fins arranged between respective adjacent pairs of refrigerant passing bodies, and a refrigerant inlet header and a refrigerant outlet header arranged on the upper side of the heat exchange core side by side in the front-rear direction and each having at least one end positioned at a widthwise outer end of the heat exchange core, the inlet header having a refrigerant inlet at said one end thereof positioned at the widthwise outer end of the heat exchange core, the outlet header having a refrigerant outlet at said one end alongside the inlet, a second fin being disposed outside the refrigerant passing body positioned at said widthwise outer end of the heat exchange core, a side plate

being disposed externally of the second fin, the evaporator being so adapted that a refrigerant flows into the inlet header through the inlet, returns to the outlet header after flowing through all the refrigerant passing bodies and is sent out from the outlet,

the second fin and the side plate having respective upper ends so positioned as to permit an upper portion outer surface of the core-end refrigerant passing body to be exposed, a refrigerant inflow member and a refrigerant outflow member being arranged on the core-end refrigerant passing body at an external portion thereof above the second fin and the side plate, the inflow member being connected to the inlet of the inlet header, the outflow member being connected to the outlet of the outlet header, the inflow member and the outflow member having respective outer side faces positioned laterally externally of the heat exchange core and positioned within an upward extension of the plane of an outer side face of the side plate or inwardly of the extension.

2) An evaporator according to par. 1) wherein the inflow member and the outflow member each comprise a tube which is open at one end and closed at the other end and has a pipe joint opening at the open end, and the inflow member and the outflow member are connected, each at a peripheral wall portion thereof toward the closed end, to the inlet of the inlet header and the outlet of the outlet header respectively.

3) An evaporator according to par. 1) wherein an outwardly projecting flange is formed around each of the inlet of the inlet header and the outlet of the outlet header, and the inflow

member and the outflow member are joined respectively to the inlet header and the outlet header with the flange fitted in a through hole formed in a peripheral wall of each of the inflow member and the outflow member.

4) An evaporator according to par. 3) wherein the inlet of the inlet header and the outlet of the outlet header are each oblong, and the through hole formed in the peripheral wall of each of the inflow member and the outflow member is an oblong hole for the flange around each of the inlet and the outlet to fit in.

5) An evaporator according to par. 1) wherein one of the inflow member and the outflow member which is positioned in front of the other extends forward from a closed end thereof, and the other member extends forward from a closed end thereof as bent to clear said one member in front.

6) An evaporator according to par. 1) wherein one of the inflow member and the outflow member which is positioned in front of the other extends forward straight from a closed end thereof, and the other member is curved downwardly forward from a closed end thereof and has an outer end extending straight forward.

7) An evaporator according to par. 1) wherein the side plate is provided at the upper end thereof with a portion bent toward the refrigerant passing body, and the inflow member and the outflow member are rectangular in cross section and have their outer side faces positioned within the upward extension of the plane of the outer side face of the side plate, a covering member being provided for closing a space between

the upper-end bent portion of the side plate and a lower end of one of the inflow member and the outflow member which is positioned in the rear of the other when the space is seen from the front.

8) An evaporator according to par. 7) wherein the side plate has an upward bent portion integral with a free end of the bent portion, and the covering member is provided integrally with at least one of front and rear side edges of the upward bent portion.

9) An evaporator according to par. 1) which comprises a plurality of flat hollow bodies each comprising two vertically elongated rectangular plates brazed to each other along peripheral edges thereof and having bulging refrigerant passageway portions and bulging header forming portions continuous with opposite ends of the passageway portions of the plates, the flat hollow bodies being arranged side by side with opposed outer faces of corresponding header forming portions in contact with each other, the corresponding header forming portions of each adjacent pair of flat hollow bodies being joined to each other at their outer faces, the refrigerant passing bodies of the heat exchange core being provided by the passageway portions of the flat hollow bodies.

10) An evaporator according to par. 9) wherein the plurality of flat hollow bodies are arranged in succession from the widthwise outer end of the heat exchange core and have bulging header forming portions providing the inlet header and the outlet header.

11) An evaporator according to par. 1) wherein each of

the refrigerant passing bodies of the heat exchange core comprises a tube having a plurality of parallel refrigerant channels.

12) An evaporator according to par. 11) which comprises a plurality of intermediate headers in addition to the inlet header and the outlet header, and two tube groups each comprising refrigerant passing bodies arranged at a spacing in at least one row are arranged respectively between the inlet header and one of the intermediate headers opposed thereto and between the outlet header and another one of the intermediate headers opposed thereto, the refrigerant passing bodies of each of the tube groups having opposite ends joined to the respective corresponding headers opposed to each other.

13) An evaporator according to par. 12) wherein the inlet header and the outlet header are provided by dividing interior of a refrigerant inlet-outlet tank into front and rear two portions by a partition wall.

14) An evaporator according to par. 13) wherein the inlet-outlet tank comprises a first member having the refrigerant passing bodies joined thereto, a second member brazed to the first member at a portion thereof opposite to the refrigerant passing bodies, and caps brazed to respective opposite ends of the first and second members, the partition wall being integral with the second member, one of the caps being provided with the inlet and the outlet.

15) A refrigeration cycle comprising a compressor, a condenser and an evaporator, the evaporator being an evaporator according to any one of par. 1) to 14).

16) A vehicle having installed therein a refrigeration cycle according to par. 15) as an air conditioner.

With the evaporator described in par. 1), the upper ends of the second fin and the side plate are so positioned as to expose the upper portion outer side surface of the core-end refrigerant passing body, and the refrigerant inflow and outflow members are positioned at an external portion of the end refrigerant passing body above the second fin and the side plate, are connected respectively to the inlet of the inlet header and the outlet of the outlet header and have respective outer side faces positioned laterally externally of the core and positioned within, or inwardly of, an upward extension of the plane of outer side face of the side plate. Accordingly, the width of the heat exchange core is the overall width of the evaporator. Consequently the evaporator can be housed in a case without leaving any useless space inside the case, and if the evaporator is compacted, the case can be made smaller in size. This makes it possible to give an enlarged space to the vehicle compartment to ensure comfort although the vehicle is limited in size.

With the evaporator described in par. 2), the inflow member and the outflow member are each in the form of a tube open at one end and closed at the other end, each have a pipe joint opening at the open end, and are connected, each at a peripheral wall portion thereof toward the closed end, to the inlet of the inlet header and the outlet of the outlet header respectively. For this reason, the inlet pipe and the outlet pipe to be connected to the respective pipe joint openings of the inflow and outflow

members can be of a relatively simple shape. As a result, the inlet pipe and the outlet pipe can be of bent portions of relatively great radius of curvature, have no reduction in the cross sectional area of the flow channel to diminish the pressure loss of the refrigerant, permitting the evaporator to exhibit the desired heat exchange performance free of impairment.

With the evaporator described in par. 3), the inflow member and the outflow member can be connected respectively to the inlet of the inlet header and the outlet of the outlet header reliably.

With the evaporator described in par. 4), the inflow member and the outflow member are prevented from rotating and can be positioned in place reliably.

With the evaporator described in par. 5), interference is avoidable between the inflow member and the outflow member.

With the evaporator described in par. 6), the inlet pipe and the outlet pipe to be connected to the respective pipe joint openings of the inflow and outflow members can be of a relatively simple shape, e.g., can be in the form of a straight pipe. This gives a relatively great radius of curvature to the bent portions of the inlet pipe and outlet pipe to result in no reduction in the flow channel cross sectional area and a diminished refrigerant pressure loss, preventing the impairment of heat exchange performance.

When the evaporator describe in par. 7) is housed in a case, air is prevented from flowing inside the case around the evaporator. This greatly reduces the amount of air not

end, a refrigerant inflow member, a refrigerant outflow member, and a side plate. FIG. 7 is a perspective view showing aluminum plates for making a flat hollow body different from those shown in FIGS. 5 and 6. FIG. 8 is an exploded perspective view showing a flat hollow body different from those shown in FIGS. 5 to 7. FIG. 9 is a diagram showing how a refrigerant flows through the evaporator of Embodiment 1. FIG. 10 is a perspective view partly broken away and showing the overall construction of an evaporator of Embodiment 2 of the invention. FIG. 11 is a fragmentary view in vertical section showing the evaporator of FIG. 10 as it is seen from one side.

BEST MODE OF CARRYING OUT THE INVENTION

Embodiments of the present invention will be described below with reference to the drawings.

Embodiment 1

This embodiment is shown in FIGS. 1 to 9.

FIGS. 1 to 3 show the overall construction of the evaporator of the embodiment, and FIGS. 4 to 8 show the constructions of the main portions thereof. FIG. 9 shows the flow of a refrigerant through the evaporator of the embodiment. In the description of Embodiment 1, the left- and right-hand sides of FIGS. 2 and 3 will be referred to as "left" and "right."

With reference to FIG. 1, the evaporator 1 is of the stacked plate type and comprises a heat exchange core 4 having a plurality of flat refrigerant passing bodies 2 arranged in parallel with their widths pointing toward the front-rear direction and first corrugated aluminum fins 3 arranged

passing through the heat exchange core to preclude the impairment of refrigeration efficiency. Moreover, there is no need to block clearances inside the case around the evaporator with a heat insulating material, and therefore no need for such a procedure to result in a lower material cost.

The evaporator described in par. 8) can be provided with the covering member easily.

With the evaporator described in par. 9), the width of the heat exchange core is variable easily by varying the number of vertically elongated rectangular metal plates, i.e. the number of flat hollow bodies.

The evaporator described in par. 13) can be reduced in the number of components in its entirety.

With the evaporator described in par. 14), the partition wall of the inlet-outlet tank is integral with the second member and can therefore be provided inside the tank by facilitated work.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view showing the overall construction of an evaporator of Embodiment 1 of the invention. FIG. 2 is a view in section taken along the line II-II in FIG. 1. FIG. 3 is a view in section taken along the line III-III in FIG. 2. FIG. 4 is a view in cross section of refrigerant passageways of a flat hollow body for use in the evaporator in FIG. 1. FIG. 5 is an exploded perspective view of the flat hollow body for use in the evaporator of FIG. 1. FIG. 6 is an exploded perspective view of a flat hollow body at the right

between respective adjacent pairs of refrigerant passing bodies, a refrigerant inlet header 5 provided at a right front portion on the upper side of the heat exchange core 4 and extending in the left-right direction, i.e., laterally of the evaporator, a refrigerant outlet header 6 provided in the rear of and alongside the inlet header 5 and extending laterally of the evaporator, a first intermediate header 7 disposed under the heat exchange core 4, opposed to the inlet header 5 and extending laterally of the evaporator, a second intermediate header 8 extending leftward from the first intermediate header 7 laterally of the evaporator, a third intermediate header 9 disposed on the upper side of the core 4, opposed to the second intermediate header 8 and extending leftward from the inlet header 5 laterally of the evaporator, a fourth intermediate header 10 disposed in the rear of and alongside the third intermediate header 9 and extending leftward from the outlet header 6 laterally of the evaporator, a fifth intermediate header 11 disposed under the core 4, opposed to the fourth intermediate header 10 and extending laterally of the evaporator, and a sixth intermediate header 12 extending rightward from the fifth intermediate header 11 laterally of the evaporator and opposed to the outlet header 6 (see FIG. 9). Through the refrigerant passing bodies 2 of the heat exchange core 4, the inlet header 5 communicates with the first intermediate header 7, the second intermediate header 8 with the third intermediate header 9, the fourth intermediate header 10 with the fifth intermediate header 11, and the sixth intermediate header 12 with the outlet header 6.

The inlet header 5 has a refrigerant inlet 14 at its right end, and the outlet header 6 has a refrigerant outlet 15 at is right end. A refrigerant inflow aluminum member 16 is connected to the inlet 15, and a refrigerant outflow aluminum member 17 to the outlet 15.

With reference to FIGS. 2 to 4, a plurality of flat hollow bodies 19, 19A, 19B, 19C, 19D, each comprising two vertically elongated rectangular aluminum plates 18, 18A, 18B, 18C, 18D brazed to each other, are arranged side by side laterally of the evaporator and joined to one another into an assembly to provide all the refrigerant passing bodies 2 of the heat exchange core 4 and all the headers 5 to 12. Each of the aluminum plates 18, 18A, 18B, 18C, 18D comprises an aluminum brazing sheet having a brazing material layer over opposite surfaces thereof. Formed between each pair of aluminum plates 18, 18A, 18B, 18C, 18D providing each flat hollow body 19, 19A, 19B, 19C, 19D are front and rear two bulging refrigerant passageways 21, 22 extending vertically. The pair of aluminum plates have bulging header forming portions 23, 24 continuous with the upper and lower ends of the plate portions defining the respective passageways 21, 22. A corrugated inner aluminum fin 25 is disposed in both the front and rear passageways 21, 22 of each flat hollow body 19, 19A, 19B, 19C, 19D and blazed to the pair of aluminum plates 18, 18A, 18B, 18C, 18D. Alternatively, two corrugated inner aluminum fins may be provided in the respective passageways 21, 22.

The header forming portions 23, 24 of the flat hollow body 19, 19A, 19B, 19C, 19D have a larger left-to-right thickness

than the passageways 21, 22. Each adjacent pair of hollow bodies 19, 19A, 19B, 19C, 19D are brazed to each other at the outer faces of the header forming portions 23, 24 thereof. The portions of the hollow body 19, 19A, 19B, 19C, 19D forming the passageways 21, 22 provide the refrigerant passing body 2 of the heat exchange core 4, and the upper and lower front header forming portions 23 of the hollow body form the inlet header 5 or the third intermediate header 9, and the first or second intermediate header 7 or 8. Similarly, the upper and lower rear header forming portions 24 of the hollow body form the outlet header 6 or the fourth intermediate header 10, and the fifth or sixth intermediate header 11 or 12.

The passageway-defining portions of each adjacent pair of flat hollow bodies 19, 19A, 19B, 19C, 19D form an air flow clearance therebetween. The first corrugated fin 3, which has crest portions and furrow portions extending in the front-rear direction, is provided in the air flow clearance and brazed to the pair of hollow bodies. The flat hollow body 19A at the right end is provided on the outer side thereof other than an upper portion thereof with a side plate 26 as spaced from the hollow body 19A, and the side plate 26 and the hollow body 19A also form an air flow clearance therebetween. A second corrugated fin 27 having crest portions and furrow portions which extend in the front-rear direction is provided in this air flow clearance and brazed to the hollow body 19A and the side plate 26. The side plate 26 comprises an aluminum brazing sheet having brazing material layer over opposite surfaces thereof. The side plate 26 and the fin 27

have upper ends positioned below the inlet header 5 and the outlet header 6, permitting the outer side surface (right side surface) of the hollow body 19A at the right end to be partly left exposed.

The flat hollow bodies 19, 19A, 19B, 19C, 19D include hollow bodies 19A at the left and right ends of the evaporator 1. The inlet header 5, outlet header 6, first intermediate header 7, sixth intermediate header 12 and right side portion of the heat exchange core 4 are provided by hollow bodies 19, 19A, 19B, which include a hollow body 19B at the left end of the right side core portion. The second to fifth intermediate headers 8 to 11 and the left side portion of the core 4 are provided by flat hollow bodies 19, 19A, 19C, 19D, which include a hollow body 19C at the right end of the left side core portion, and a plurality of hollow bodies 19D, i.e., two hollow bodies 19D, arranged side by side at the leftward core portion. FIG. 5 shows the construction of the flat hollow bodies 19 other than the hollow bodies 19A, 19B, 19C, 19D. As shown in FIG. 5, the right aluminum plate 18 making each hollow body 19 has front and rear two tube forming bulging portions 28 extending vertically, and four header forming bulging portions 29 integral with the upper or lower ends of the portions 28 and having a greater bulging height than these portions 28. Each header forming bulging portion 29 has a top wall provided with a through hole 31. The through holes 31 in the top walls of the upper rear and lower front header forming bulging portions 29 are each surrounded or defined by a flange 32 projecting rightward and integral with the portion 29. The left aluminum plate

18 making the hollow body 19 is in a reversed relation with the right aluminum plate with respect to the left-right direction, and like parts of these two plates will be designated by like reference numerals. The flat hollow body 19 is made by arranging the two aluminum plates 18 in combination, with each corresponding pair of openings of the bulging portions 28, 29 opposed to each other, and with an inner fin 25 interposed between the plates 18, and brazing the arrangement. Each adjacent pair of flat hollow bodies 19 are brazed to each other at the opposed outer faces of the header forming portions 23, 24, with the flanges 32 of one of the bodies 19 fitted into the through bores 31 of the other hollow body 19, whereby the header forming portions 23, 24 of the adjacent pair of hollow bodies 19 are held in communication in corresponding relation respectively.

FIG. 6 shows the construction of the flat hollow body 19A at the right end. As shown in FIG. 6, the right-end hollow body 19A comprises a right aluminum plate 18A having header forming bulging portions 29A which are all equal to tube forming bulging portions 28 thereof in bulging height. The right aluminum plate 18A has lower two header forming bulging portions 29A which are provided with no through hole in their top walls. The right aluminum plate 18A further has an upper front header forming bulging portion 29A, which is provided with the refrigerant inlet 14 formed in its top wall. The inlet 14 is in the form of an oblong through hole elongated in the front-rear direction. The aluminum plate 18A has an upper rear header forming bulging portion 29A, which is provided

with the refrigerant outlet 15 formed in its top wall. The outlet 15 is in the form of an oblong through hole elongated in an upwardly rearward direction as inclined from a vertical. The refrigerant inlet 14 and outlet 15 in the top walls of the header forming bulging portions 29A are surrounded by respective flanges 33, 34 projecting rightward and each integral with the bulging portion 29A. Although not shown, the flat hollow body 19A at the left end has the same construction as the right-end hollow body 19A except that all header forming bulging portions 29A thereof have no through hole formed in their top walls, and is positioned as reversed with respect to the left-right direction. With exception of the features described above, the flat hollow bodies 19A at the left and right ends have the same construction as the flat hollow body 19 shown in FIG. 5. Like each adjacent pair of flat hollow bodies 19 which are brazed to each other at the header forming portions 23, 24, the laterally inwardly facing faces of the header forming portions 23, 24 are brazed to the outer faces of the respective header forming portions 23, 24 of the hollow body 19 which is positioned laterally inwardly of and adjacent to the hollow body 19A, whereby the header forming portions 23, 24 of the adjacent pair of hollow bodies 19A, 19 are held in communication in corresponding relation respectively.

While the inlet header 5, outlet header 6, first intermediate header 7, sixth intermediate header 12 and right side portion of the heat exchange core 4 are provided by hollow bodies 19, 19A, 19B, the hollow body 19B positioned at the left end of the right side core portion and included among

portions 23, 24, the left side faces of the header forming portions 23, 24 are brazed to the outer faces of the respective header forming portions 23, 24 of the hollow body 19 which is positioned on the left side of and adjacent to the hollow body 19C, whereby the header forming portions 23, 24 of the adjacent pair of hollow bodies 19C, 19 are held in communication in corresponding relation respectively.

Further like the adjacent pair of flat hollow bodies 19 which are brazed to each other at the header forming portions 23, 24, the flat hollow body 19B and the flat hollow body 19C are brazed to each other at the opposed outer faces of their header forming portions 23, 24, whereas these hollow bodies 19B, 19C are not in communication between each of the corresponding pairs of upper header forming portions 23, 24.

The second to fifth intermediate headers 8 to 11 are provided by the flat hollow bodies 19, 19A, 19C, 19D, which include a plurality of, i.e., two, flat hollow bodies 19D which are arranged side by side at a left side portion of the evaporator. FIG. 8 shows the construction of the hollow body 19D. With reference to FIG. 8, the hollow body 19D comprises a right aluminum plate 18D having upper two header forming bulging portions 29, between which the aluminum plate 18D is bulged to the same height as the bulging portions 29 to provide a communication bulging portion 35. The two header forming bulging portions 29 are held in communication with each other by the bulging portion 35. The flat hollow body 19D further comprises a left aluminum plate 18D, which is in a reverse relation with the right aluminum plate 18D with respect to

these hollow bodies has a left aluminum plate 18B. The second to fifth intermediate headers 8 to 11 and the left side portion of the core 4 are provided by flat hollow bodies 19, 19A, 19C, 19D, and the hollow body 19C positioned at the right end of the left side core portion and included among these hollow bodies has a right aluminum plate 18C. The left and right aluminum plates 18B and 18C are shown in FIG. 7.

With reference to FIG. 7, the left aluminum plate 18B has an upper front header forming bulging portion 29B which is provided with no through hole in its top wall. With the exception of this feature, the flat hollow body 19B has the same construction as the hollow body 19 shown in FIG. 5. Like each adjacent pair of flat hollow bodies 19 which are brazed to each other at the header forming portions 23, 24, the right side faces of the header forming portions 23, 24 are brazed to the outer faces of the respective header forming portions 23, 24 of the hollow body 19 which is positioned on the right side of and adjacent to the hollow body 19B, whereby the header forming portions 23, 24 of the adjacent pair of hollow bodies 19B, 19 are held in communication in corresponding relation respectively. The right aluminum plate 18C is in a reverse relation with the left aluminum plate 18B with respect to the left-right direction, and has an upper rear header forming bulging portion 29C which is provided with no through hole in its top wall. With the exception of this feature, the flat hollow body 19C has the same construction as the hollow body 19 shown in FIG. 5. Like each adjacent pair of flat hollow bodies 19 which are brazed to each other at the header forming

the left-right direction. With respect to these left and right plates 18D, like parts are designated by like reference numerals. With the exception of the above feature, the flat hollow body 19D has the same construction as the hollow body 19 shown in FIG. 5. Like the adjacent pair of flat hollow bodies 19 which are brazed to each other at the header forming portions 23, 24, these hollow bodies 19D are brazed to each other and the hollow portion 19D is brazed to the hollow body 19 adjacent thereto at the opposed outer side faces of the header forming portions 23, 24. Accordingly, the third intermediate header 9 is held in communication with the fourth intermediate header 10 by communication bulging portions 35.

With reference to FIG. 6, the refrigerant inflow member 16 is in the form of a rectangular tube having a rectangular cross section, and is open at one end and closed at the other end. The inflow member 16 extends forward straight from a side end portion of the refrigerant inlet 14 and is projected forward beyond the heat exchange core 4. The inflow member 16 has an open end portion which is deformed to a circular cross section over a predetermined length to provide a pipe joint opening 36 for connection to a refrigerant inlet pipe (not shown). The inflow member 16 has a left side wall having an oblong through hole 37 positioned toward the closed end and elongated in the front-rear direction. The inflow member 16 is brazed to the flat hollow body 19A utilizing the brazing material layer of the aluminum plate 18A, with the flange 33 around the refrigerant inlet 14 fitted in the through hole 37.

The refrigerant outflow member 17 is in the form of a rectangular tube having a rectangular cross section, and is open at one end and closed at the other end. To clear the inflow member 16, the outflow member 17 is curved downwardly forward from a side end portion of the refrigerant outlet 15 and has an outer end extending forward straight and projecting forward beyond the heat exchange core 4. Alternatively, the outflow member 17 may extend downward straight from the side end portion of the outlet 15, is then bent at a right angle to provide an outer end portion extending forward straight and projecting forward beyond the core 4. The portion of the outflow member 17 projecting forward beyond the core 4 is entirely straight and extends straight forward. The outflow member 17 has an open end portion which is deformed to a circular cross section over a predetermined length to provide a pipe joint opening 38 for connection to a refrigerant outlet pipe (not shown). The outflow member 17 has a left side wall having an oblong through hole 39 positioned toward the closed end and elongated in an upwardly rearward oblique direction slanting with respect to a vertical. The outflow member 17 is brazed to the flat hollow body 19A utilizing the brazing material layer of the aluminum plate 18A, with the flange 34 around the refrigerant outlet 15 fitted in the through hole 39. The outflow member 17 is equal to the inflow member 16 in left-to-right thickness.

The side plate 26 is positioned below the refrigerant outflow member 17. The side plate 26 has two leftward bent portions 41 formed respectively at its upper and lower ends.

The leftward bent portions 41 have a left-to-right width equal to the left-to-right thickness of the inflow member 16 and the outflow member 17. The right outer side faces of these inflow and outflow members 16, 17 are positioned within an upward extension of the plane of the side plate 26. The upper leftward bent portion 41 is integrally provided with an upward bent portion 42 at its inner end, and the lower leftward bent portion 41 is integrally provided with a downward bent portion 43 at its inner end. The boundary between the upward bent portion 42 and the leftward bent portion 41 has a slit of predetermined length extending from each of the front and rear ends of the upward bent portion 42, and the front and rear end portions of the upward bent portions 42 are bent rightward. The rightward bent portions 44 are equal to the leftward bent portion 41 in left-to-right width, and have a vertical length equal to the distance between the upper leftward bent portion 41 and the lower end of the outflow member 17. The rightward bent portions 44 serve as covering members for closing the space between the outflow member 17 and the upper leftward bent portion 41 of the side plate 26.

The evaporator 1 is fabricated by tacking the components in combination and brazing the tacked assembly collectively.

The evaporator 1 is housed in a case C provided in the compartment of a vehicle, for example, of a motor vehicle. Along with a compressor and a condenser, the evaporator 1 constitutes a refrigeration cycle, which is used as a motor vehicle air conditioner. Since the right outer side faces of the refrigerant inflow member 16 and outflow member 17 are

positioned in an upward extension of the plane of the side plate 26, the case C having the evaporator 1 housed therein has no useless space in its interior as shown in FIGS. 2 and 3. If the evaporator 1 is compacted, the case C can be small-sized. Consequently, an enlarged space is made available to ensure the comfort of the vehicle compartment although the vehicle body is limited in size.

With the evaporator 1 described, a two-layer refrigerant of vapor-liquid mixture phase flowing through a compressor, condenser and expansion valve is sent into the refrigerant inflow member 16 through the inlet pipe and admitted into the refrigerant inlet header 5 via the through hole 37 of the inflow member 16 and the refrigerant inlet 14. The refrigerant flowing into the inlet header 5 dividedly flows into the front refrigerant passageways 21 of all the refrigerant passing bodies 2 communicating with the inlet header 5, flows down the passageways 21 into the first intermediate header 7, and then flows leftward into the second intermediate header 8. The refrigerant flowing into the second intermediate header 8 dividedly flows into the front passageways 21 of all the refrigerant passing bodies 2 in communication with the second intermediate header 8, and flows up the passageways 21 into the third intermediate header 3. The refrigerant in the header 3 flows through the communication bulging portions 35 of the flat hollow bodies 19D into the fourth intermediate header 10, dividedly flows into the rear refrigerant passageways 22 of all the refrigerant passing bodies 2 communicating with the fourth intermediate header 10, flows down the passageways

22 into the fifth intermediate header 11, then flows rightward into the sixth intermediate header 12. The refrigerant flowing into the header 12 dividedly flows into the rear refrigerant passageways 22 of all the refrigerant passing bodies 2 communicating with the sixth intermediate header 12, flows up the passageways 22 into the outlet header 6. The refrigerant in the outlet header 6 enters the outflow member 17 via the outlet 15 and the through hole 39 and is sent out through the outlet pipe. While flowing through the passageways 21, 22 of the refrigerant passing bodies 2, the refrigerant is subjected to heat exchange with the air flowing through the air flow clearances in the direction indicated by the arrow X in FIGS. 1 and 9 and flows out in the form of a vapor phase. At this time, the rightward bent portions 44 serving as covering members prevent the air from flowing through the space between the lower end of the outflow member 17 and the upper leftward bent portion 31 of the side plate 26. The outflow member 17 also prevents air from flowing through a space inside the case C around the heat exchange core 4.

Embodiment 2

This embodiment is shown in FIGS. 10 and 11. Throughout the drawings, i.e., FIGS. 1 to 11, like parts will be designated by like reference numerals and will not be described repeatedly. In the description of Embodiment 2, the left- and right-hand sides of FIG. 10 will be referred to as "left" and "right."

FIGS. 10 and 11 show an evaporator 50, which comprises a refrigerant inlet-outlet tank 51 of aluminum and a refrigerant turn tank 52 of aluminum which are arranged as vertically

spaced apart, and a heat exchange core 53 provided between the two tanks 51, 52.

The refrigerant inlet-outlet tank 51 comprises a refrigerant inlet header 54 positioned on the front side (the downstream side with respect to the direction of flow of air), and a refrigerant outlet header 55 positioned on the rear side (the upstream side with respect to the flow of air). The refrigerant turn tank 52 comprises a refrigerant inflow header 56 (intermediate header) positioned on the front side, and a refrigerant outflow header 57 (intermediate header) positioned on the rear side.

The inlet header 54 has a refrigerant inlet 14 at its right end, and the outlet header 55 has a refrigerant outlet 15 at its right end. A refrigerant inflow aluminum member 16 is connected to the inlet 14, and a refrigerant outflow aluminum member 17 to the outlet 15.

The heat exchange core 53 comprises tube groups 59 in the form of a plurality of rows, i.e., two rows in the present embodiment, as arranged in the front-rear direction, each tube group 59 comprising a plurality of heat exchange tubes 58 (refrigerant passing bodies) arranged in parallel in the left-right direction, i.e., laterally of the evaporator, at a spacing. The heat exchange tubes 58 of the front tube group 59 have upper and lower ends joined respectively to the inlet header 54 and the inflow header 56. The heat exchange tubes 58 of the rear tube group 59 have upper and lower ends joined respectively to the outlet header 55 and the outflow header 57. The spaces between respective adjacent pairs of heat

exchange tubes 58 of the tube groups 59 serve as air passing clearances. First corrugated fins 61 having crest portions and furrow portions extending in the front-rear direction are arranged in the air passing clearances, and are each brazed to the tubes 58 adjacent thereto. A side plate 62 is disposed outside the heat exchange tubes 58 at the left ends of the tube groups 59 and spaced apart from the end tubes 58. A first corrugated fin 61 having crest portions and furrow portions extending in the front-rear direction is disposed also in the space between the side plate 62 and the end tubes 58 which space serves as an air passing clearance, and is brazed to the end tubes 58 and the side plate 62. The heat exchange tubes 58 at the right ends of the tube groups 59 are provided, except for the upper portions thereof, with a side plate 26 as spaced apart from the end tubes 58, and the space between the side plate 62 and the end tubes 58 also serves as an air passing clearance. A second corrugated fin 63 having crest portions and furrow portions extending in the front-rear direction is provided in this clearance and brazed to the end tubes 58 and the side plate 26.

The refrigerant inlet-outlet tank 51 comprises a platelike first member 64 made of an aluminum brazing sheet having a brazing material layer over opposite surfaces thereof and having the heat exchange tubes 58 joined thereto, a second member 65 of bare aluminum extrudate and covering the upper side of the first member 64, and aluminum caps 66, 67 made of an aluminum bare material and joined to the respective ends of the members 64, 65 for closing left and right end openings.

The first member 64 has at each of the front and rear side portions thereof a curved portion 68 in the form of a circular arc of small curvature in cross section and bulging downward at its midportion. The curved portion 68 has a plurality of tube insertion slits 69 elongated forward or rearward and arranged at a spacing in the lateral direction. Each corresponding pair of slits 69 in the front and rear curved portions 68 are in the same position with respect to the lateral direction. The front edge of the front curved portion 68 and the rear edge of the rear curved portion 68 are integrally provided with respective upstanding walls 68a extending over the entire length of the member 64. The first member 64 includes between the two curved portions 68 a flat portion 71 having a plurality of through holes 72 arranged at a spacing in the lateral direction.

The second member 65 is generally m-shaped in cross section and opened downward and comprises front and rear two walls 73 extending laterally, a partition wall 74 provided in the midportion between the two walls 73 and extending laterally to divide the interior of the refrigerant inlet-outlet tank 51 into front and rear two spaces, and two generally circular-arc connecting walls 75 bulging upward and integrally connecting the partition wall 74 to the respective front and rear walls 73 at their upper ends. The front and rear wall 73 of the second member 65 and the partition wall 74 are integrally interconnected at their lower ends by a flow dividing resistance plate 76 over the entire length of the member 65 for separating the interior of the outlet header 55 into upper and lower two

spaces 55a, 55b.

The resistance plate 76 has laterally elongated refrigerant passing oblong holes 77 formed therein at a rear portion thereof other than the left and right end portions of the plate and arranged at a spacing laterally thereof.

The partition wall 74 of the second member 65 has a lower end projecting downward beyond the lower ends of the front and rear walls 73 and is integrally provided with a plurality of projections 74a projecting downward from the lower edge of the wall 74, arranged at a spacing in the lateral direction and fitted into the through holes 72 of the first member 64. The projections 74a are formed by cutting away specified portions of the partition wall 74.

The second member 65 is produced by extruding the front and rear walls 73, partition wall 74, connecting walls 75 and flow dividing resistance plate 76 in the form of an integral piece, thereafter subjecting the extrudate to press work to form the refrigerant passing holes 77 in the resistance plate 76, and further cutting away portions of the partition wall 74 to form the projections 74a.

The caps 66, 67 are made from a bare material as by press work, forging or cutting, each have a recess facing laterally inward for the corresponding left or right ends of the first and second members 64, 65 to fit in. The right cap 67 has through holes, i.e., the refrigerant inlet 14 in communication with the inlet header 54 and the refrigerant outlet 15 communicating with the upper space 55a of the outlet header 55. The inlet 14 is oblong and elongated in the front-rear

direction, while the outlet 15 is oblong and elongated in an upwardly rearwardly direction inclined with respect to a vertical. Although not shown, the inlet 14 and the outlet 15 of the right cap are surrounded by respective flanges integral with the cap, projecting rightward and fittable into respective through holes 37 in the inflow member 16 and the outflow member 17.

The two members 64, 65 are brazed to each other utilizing the brazing material layer of the first member 64, with the projections 74a of the second member 65 inserted in the respective holes 72 of the first member 64 and with the front and rear upstanding walls 68a of the first member 64 in engagement with the front and rear walls 73 of the second member 65. The two caps 66, 67 are further brazed to the first and second members 64, 65 using a brazing material sheet. Thus, the inlet-outlet tank 51 is made. The portion of the tank forwardly of the partition wall 74 of the second member 65 serves as the refrigerant inlet header 54, and the portion thereof rearwardly of the partition wall 74 as the refrigerant outlet header 55.

The refrigerant turn tank 52 comprises a platelike first member 78 made of aluminum brazing sheet having a brazing material layer over opposite surfaces thereof and having the heat exchange tubes 58 joined thereto, a second member 79 made of bare aluminum extrudate and covering the lower side of the first member 78, and aluminum caps 81 for closing left and right opposite end openings.

The refrigerant turn tank 52 has a top surface 52a which

is in the form of a circular-arc in cross section in its entirety such that the midportion thereof with respect to the front-rear direction is the highest portion 82 which is gradually lowered toward the front and rear sides. The tank 52 is provided in its front and rear opposite side portions with grooves 83 extending from the front and rear opposite sides of the highest portion 82 of the top surface 52a to front and rear opposite side surfaces 52b, respectively, and arranged laterally at a spacing.

The first member 78 has a circular-arc cross section bulging upward at its midportion with respect to the forward or rearward direction and is provided with a depending wall 78a formed at each of the front and rear side edges thereof integrally therewith and extending over the entire length of the member 78. The upper surface of the first member 78 serves as the top surface 52a of the refrigerant turn tank 52, and the outer surface of the depending wall 78a as the front or rear side surface 52b of the tank 52. The grooves 83 are formed in each of the front and rear side portions of the first member 78 and extend from the highest portion 82 in the midportion of the member 78 with respect to the front-rear direction to the lower end of the depending wall 78a. In each of the front and rear side portions of the first member 78 other than the highest portion 82 in the midportion thereof, tube insertion slits 84 elongated in the front-rear direction are formed between respective adjacent pairs of grooves 83. Each corresponding pair of front and rear tube insertion slits 84 are in the same position with respect to the lateral direction. The first

member 78 has a plurality of through holes 85 formed in the highest portion 82 in the midportion thereof and arranged laterally at a spacing. The depending walls 78a, grooves 83, tube insertions slits 84 and through holes 85 of the first member 78 are formed at the same time by making the member 78 from an aluminum brazing sheet by press work.

The second member 79 is generally w-shaped in cross section and opened upward, and comprises front and rear two walls 86 curved upwardly outwardly forward and rearward, respectively, and extending laterally, a vertical partition wall 87 provided at the midportion between the two walls 86, extending laterally and dividing the interior of the refrigerant turn tank 52 into front and rear two spaces, and two connecting walls 88 integrally connecting the partition wall 87 to the respective front and rear walls 86 at their lower ends. The partition wall 87 is provided with a plurality of projections 87a projecting upward from the upper edge thereof integrally therewith, arranged laterally at a spacing and fitted into the respective through holes 85 in the first member 78. The partition wall 87 has refrigerant passing cutouts 87b formed in its upper edge between respective adjacent pairs of projections 87a. The projections 87a and the cutouts 87b are formed by cutting away specified portions of the partition wall 87.

The second member 79 is produced by extruding the front and rear walls 86, partition wall 87 and connecting walls 88 as an integral piece and cutting the partition wall 87 to form the projections 87a and cutouts 87b.

The caps 81 are made from a bare material as by press work, forging or cutting, and each have a recess facing laterally inward for the corresponding left or right ends of the first and second members 78, 79 to fit in.

The two members 78, 79 are brazed to each other utilizing the brazing material layer of the first member 78, with the projections 87a of the second member 79 inserted through the respective holes 85 and with the front and rear depending walls 78a of the first member 78 in engagement with the front and rear walls 86 of the second member 79. The two caps 81 are further brazed to the first and second members 78, 79 using a brazing material sheet. In this way, the refrigerant turn tank 52 is formed. The portion of the second member 79 forwardly of the partition wall 87 serves as the inflow header 56, and the portion thereof rearwardly of the partition wall 87 as the outflow header 57. The upper-end openings of the cutouts 87b in the partition wall 87 of the second member 79 are closed with the first member 78.

The heat exchange tubes 58 providing the front and rear tube groups 59 are each made of a bare material in the form of an aluminum extrudate. Each tube 58 is flat, has a large width in the front-rear direction and is provided in its interior with a plurality of refrigerant channels (not shown) extending longitudinally of the tube and arranged in parallel. The tube 58 has front and rear opposite end walls which are each in the form of an outwardly bulging circular arc. Each corresponding pair of heat exchange tube 58 of the front tube group 59 and heat exchange tube 58 of the rear tube group 59

are in the same position with respect to the left-right direction, i.e., the lateral direction, have their upper end portions placed into tube insertion slits 69 in the first member 64 of the refrigerant inlet-outlet tank 51 and are brazed to the first member 64 utilizing the brazing material layer of the first member 64, with the tube upper ends projecting into the tank 51. These tubes 58 have their lower end portions placed into tube insertion slits 84 in the first member 78 of the refrigerant turn tank 52 and are brazed to the first member 78 utilizing the brazing material layer of the first member 78, with the tube lower ends projecting into the tank 52.

In place of the heat exchange tube 58 of aluminum extrudate, an electric resistance welded tube of aluminum may be used which has a plurality of refrigerant channels formed therein by inserting inner fins into the tube. Also usable is a tube which is made from a plate prepared from an aluminum brazing sheet having an aluminum brazing material layer on opposite sides thereof by rolling work and which comprises two flat wall forming portions joined by a connecting portion, a side wall forming portion formed on each flat wall forming portion integrally therewith and projecting from one side edge thereof opposite to the connecting portion, and a plurality of partition forming portions projecting from each flat wall forming portion integrally therewith and arranged at a spacing widthwise thereof, by bending the plate into the shape of a hairpin at the connecting portion and brazing the side wall forming portions to each other in butting relation to form

partition walls by the partition forming portions. The corrugated fins to be used in this case are those made from a bare material.

The first corrugated fin 61 is made from an aluminum brazing sheet having a brazing material layer on opposite sides thereof by shaping the sheet into a wavy form. Louvers are formed as arranged in parallel in the front-rear direction in the portions of the wavy sheet which connect crest portions thereof to furrow portions thereof. The corrugated fins 61 are used in common for the front and rear tube groups 59. The width of the fin 61 in the front-rear direction is approximately equal to the distance from the front edge of the heat exchange tube 58 in the front tube group 59 to the rear edge of the corresponding heat exchange tube 58 in the rear tube group 59. Instead of one corrugated fin serving for both the front and rear tube groups 59 in common, a corrugated fin may be provided between each adjacent pair of heat exchange tubes 58 of each tube group 59.

The second corrugated fin 63 is made from an aluminum brazing sheet having a brazing material layer on opposite sides thereof by shaping the sheet into a wavy form. Louvers are formed as arranged in parallel in the front-rear direction in the portions of the wavy sheet which connect crest portions thereof to furrow portions thereof. The corrugated fin 63 is used in common for the front and rear tube groups 59. The width of the fin 63 in the front-rear direction is approximately equal to the distance from the front edge of the heat exchange tube 58 in the front tube group 59 to the rear edge of the

corresponding heat exchange tube 58 in the rear tube group 59. Instead of one corrugated fin 63 serving for both the front and rear tube groups 59 in common, a corrugated fin may be provided between each adjacent pair of heat exchange tubes 58 of each tube group 59.

The side plate 26 and the second corrugated fin 63 have upper ends positioned below the inlet header 54 and the outlet header 55, permitting the outer side surface (right side surface) of the two head exchange tubes 58 at the right end to be partly left exposed.

With Embodiment 2, the right side faces of the inflow member 16 and the outflow member 17 are positioned also in an upward extension of the plane of the side plate 26.

The evaporator 50 is fabricated by tacking the components in combination and brazing the tacked assembly collectively.

The evaporator 50 is housed in a case (not shown) provided, in the compartment of a vehicle, such as a motor vehicle. Along with a compressor and a condenser, the evaporator constitutes a refrigeration cycle for use as a motor vehicle air conditioner. The right outer side faces of the refrigerant inflow member 16 and outflow member 17 are positioned in an upward extension of the plane of the side plate 26, so that when the evaporator 50 is housed in a case, the case has no useless space in its interior as is the case with Embodiment 1. If the evaporator 50 is compacted, the case can be made smaller in size. Consequently, an enlarged space is made available to ensure the comfort of the vehicle compartment although the vehicle body is limited in size.

With the evaporator 1 described, a two-layer refrigerant of vapor-liquid mixture phase flowing through a compressor, condenser and expansion valve is sent into the refrigerant inflow member 16 through the inlet pipe and admitted into the inlet header 54 of the inlet-outlet tank 51 via the through hole 37 of the inflow member 16 and the refrigerant inlet 14. The refrigerant then dividedly flows into the refrigerant channels of all the heat exchange tubes 58 of the front tube group 59.

The refrigerant flowing into the channels of all the heat exchange tubes 58 flows down the channels, ingresses into the inflow header 56 of the refrigerant turn tank 52, and flows through the cutouts 87b of the partition wall 87 into the outflow header 57. The refrigerant in the outflow header 57 dividedly flows into the refrigerant channels of all the heat exchange tubes 58 of the rear tube group 59, changes its course and passes upward through the channels into the lower space 55b of the outlet header 55 of the inlet-outlet tank 51.

Subsequently, the refrigerant flows through the refrigerant passing holes 77 of the resistance plate 76 into the upper space 55a of the outlet header 55, flows into the outflow member 17 via the outlet 15 and the through hole 39 and is sent out through the outlet pipe. While flowing through the heat exchange tubes 58, the refrigerant is subjected to heat exchange with the air flowing through the air passing clearances in the direction indicated by the arrow X in FIG. 10 and flows out of the evaporator in the form of a vapor phase.

INDUSTRIAL APPLICABILITY

The present invention provides an evaporator which is suitable for use in a motor vehicle air conditioner which is a refrigeration cycle to be installed in motor vehicles. The evaporator can be housed in a case without leaving any useless space inside the case, with the result that the case can be made smaller in size.